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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
KIELIN, ERIK J	
ART UNIT	**PAPER NUMBER**
2813	

DATE MAILED: 06/18/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 07-01)

Office Action Summary	Application No.	Applicant(s)	
	09/296,835	WEIMER ET AL.	
	Examiner	Art Unit	
	Erik Kielin	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 May 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *2-5,8,10-12 and 42-47* is/are pending in the application.

4a) Of the above claim(s) *46 and 47* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *2-5,8,10-12 and 42-45* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *29* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 5 May 2003 has been entered.

Election/Restrictions

2. Newly submitted claims 46 and 47 are directed to an invention that is independent or distinct from the invention originally claimed for the following reasons:

Claims 46 and 47 are drawn to patentably distinct species wherein the dielectric, pre-annealing in a steam ambient has a specified crystallinity either crystalline or non-crystalline and the annealing is a single steam annealing. Moreover, Examiner has already examined numerous species including, inter alia, the species drawn to the plurality of ways in which the steam is formed: by bubbler, by catalyst, by pyrogenic reaction between hydrogen and oxygen, and by in-situ reaction of hydrogen and oxygen; the plurality of temperature ranges, and the plurality of annealing gas compositions.

Since applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, claims 46 and 47 are withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 8, 42-45 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Each of independent claims 8 and 42-45 were amended to include the limitation that the pressure in the RTA chamber during anneal is "less than atmospheric pressure." This is not supported by the specification. While it is acknowledged that Applicant has pointed out that the instant specification provides support for this limitation at p. 9, lines 2-5 (Amendment filed 5 May 2003, p. 6, second paragraph), this pressure range is not supported in scope with the specification. The specification at the location states that atmospheric pressure or low pressure of about 1 milliTorr. This does not provide support that Applicant contemplated all pressures below atmospheric.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims **8**, 2-5, 10-12, and **45** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Patel** et al. (US 5,374,578) in view of either of **Emesh** et al. (US 5,728,603) and **Chivukula** et al. (US 6,066,581), and further in view of the excerpt from the basic textbook of **Van Zant**, (Microchip Fabrication, A Practical Guide to Semiconductor Processing, 3rd ed. McGraw-Hill: New York, 1997, pp. 157-160) and considered with the CRC Handbook of Chemistry and Physics 63rd Edition, CRC Press: Boca Raton FL, pp. D-196 to D-197 (used for a showing of inherency only).

Regarding independent claims 8 and 45, **Patel** discloses a method of forming a semiconductor device comprising,

forming an oxygen deficient dielectric (called "ferroelectric") film **14** (Figs. 2-6) such as PZT which inherently has a dielectric constant of greater than 25 (see **Emesh** col. 8, Table 1 which teaches the dielectric constant of PZT, the same ferroelectric in **Patel**);

subjecting the dielectric film to an oxidation in "[g]ases like oxygen, ozone or air" (column 4, lines 10-11) using RTA (rapid thermal annealing), which must necessarily occur, then, in an RTA chamber at a temperature range of 650-850 °C for about 5-30 seconds (as further limited by instant claims 2-4) in order to increase the oxygen content of the ferroelectric film (column 2, lines 30-33), wherein any pressure may be used (col. 4, lines 24-27) during the annealing, which reads on pressures below atmospheric pressure; and

performing a stabilizing treatment in a rapid thermal annealing chamber using oxygen anneal either before or after the ozone anneal (column 4, lines 23-29) --as further limited by instant claims 10 and 12.

Patel does not teach using wet oxidation to anneal the ferroelectric PZT layer **14**.

Emesh teaches forming an oxygen deficient ferroelectric material such as PZT; subjecting the dielectric film to a wet oxidation using a mixture comprising water and ozone in a rapid thermal annealing (RTA) chamber in order to reduce the temperature at which the ferroelectric material densifies/crystallizes and also to reduce the stress in the ferroelectric film and improves its the electrical properties (column 5, lines 50-67) which also inherently increases the oxygen content of the film as indicated by reduced leakage current (sentence bridging columns 3-4).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate water during the ozone anneal of **Patel** for the reasons indicated in **Emesh** which includes at least reducing the stress in the ferroelectric film and improving the electrical properties such as increased dielectric constant (column 5, lines 50-67; col. 8, Table 1).

Similarly, **Chivukula** teaches forming an oxygen deficient ferroelectric material such as PZT; subjecting the dielectric film to a wet oxidation using a mixture comprising water and ozone at a temperature of 450-650 °C in a rapid thermal annealing (RTA) chamber for 30 seconds to several minutes to form uniform grain sizes in the ferroelectric material in a shorter time, at reduced temperature and superior characteristics during high frequency use compared to using dry oxidation (column 14, lines 27-48). (See also column 13, lines 30-53.)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate water during the ozone anneal of **Patel** for the reasons indicated in **Chivukula**, as noted, the amount of greater than 0.005 of steam relative to the other gases is inherently taught, as noted.

Furthermore, each of **Emesh** and **Chivukula** teaches that

> "Water vapour was conveniently introduced into the annealing atmosphere of the rapid thermal anneal (RTA) system during the annealing of the PZT by passing oxygen (O_2) through a double bubbler containing purified deionized water, so that the oxygen was saturated with water vapour, e.g. using a gas flow rate of about 2 L/min." (Emesh col. 5, lines 14-28; Chivukula, col. 13, lines 40-46).

It is held absent evidence to the contrary that the steam is present in an amount greater than about 0.005 (0.5%) relative to the other gases in the chamber. Support to show inherency can be easily determined from data in the Handbook of Chemistry and Physics. Pages D-196 and D-197 of the CRC (63rd edition) provide a Table having the vapour pressure of water as a function of temperature at temperatures below 100 °C. Because each of Emesh and Chivukula teaches that the oxygen is "saturated with water" all that need be known is the temperature of the bubbler. Even if it is assumed that bubbler is as low as standard room temperature (i.e. 25 °C), the CRC table of Vapor Pressure of Water Below 100 °C, indicates that the partial pressure of water is 23.756 Torr. Since atmospheric pressure is 760 Torr, the partial pressure of water in water-saturated oxygen is $23.756/760 \approx 0.0313$ or (3.13 %). Typically bubblers are heated indicating even high partial pressures of water. Accordingly, the water vapor is inherently greater than 0.005 relative to the other gases based upon the teachings in each of **Emesh** and **Chivukula**. (See MPEP 2112.)

Patel in view of either of **Emesh** and **Chivukula**, further, does not teach using a mixture of hydrogen and oxygen to provide the steam. Instead, each of **Emesh** and **Chivukula** use a bubbler (**Emesh** at col. 5, lines 57-59; **Chivukula** at col. 13, lines 40-46).

Van Zant teaches that "Dryox," a mixture of hydrogen and oxygen which react to form a steam oxidizing mixture in the reactor, is preferred over liquid systems such as a bubbler,

because the process is cleaner and more controllable and also that "Dryox is the preferred method for production of advanced devices." (See pp. 157-160 -- especially page 160.)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use hydrogen and oxygen as taught by **Van Zant** to form the steam for the wet oxidation mixture of either of **Emesh** and **Chivukula**, for the reasons indicated in **Van Zant**, as noted and especially because "Dryox" is preferred to bubblers which **Emesh** and **Chivukula** use.

Furthermore, it would be a matter of design choice as to which method of introducing the water to the oxidizing atmosphere of **Patel** in view of **Emesh** and **Chivukula**, because it appears that any known method of providing steam would work just as well and because there is no evidence of record to indicate that the mixture of hydrogen and oxygen would work better than other methods. Rather, Applicant's specification teaches away from such unexpected results. Applicant teaches,

> "One of several techniques can be used to provide steam to a vicinity of the insulating film. Such techniques include using a **bubbled water vapor system**, a pyrogenic system or a catalytic system, or generating steam in the chamber *in situ*." (Emphasis added. See instant specification, page 3, lines 13-17.)

In other words, any of the presently notoriously well-known means to form the steam, which are specifically used in the art for oxidation, could be used, according to Applicant. Also note that the paragraph bridging pages 7 and 8 of Applicant's specification indicates specifically that a bubbler can be used in the instant invention.

Then further regarding claim 8, and additionally regarding claim 5, the ratio of hydrogen to oxygen is not taught.

However, each of **Emesh** and **Chivukula** indicate that the wet oxidation is carried out in water plus oxygen and ozone (**Emesh** at col. 5, lines 19-28; **Chivukula** at col. 13, lines 36-46). "[I]n considering the disclosure of a reference, it is proper to take into account not only specific teachings of the reference but also the inferences which one skilled in the art would reasonably be expected to draw therefrom." *In re Preda*, 401 F.2d 825, 826, 159 USPQ 342, 344 (CCPA 1968) See also *In re Lamberti*, 545 F.2d 747, 750, 192 USPQ 278, 280 (CCPA 1976). With this in mind, because each of **Emesh** and **Chivukula** teach that oxygen must be in excess of the water vapor, one of ordinary skill would know, based upon the stoichiometry of the reaction between hydrogen and oxygen to form the "Dryox" mixture containing water (as taught by **Van Zant**) that the ratio of hydrogen to oxygen must necessarily be less than or equal to about 0.67 because hydrogen reacts with oxygen in a 2 to 1 stoichiometric ratio ($2\ H_2 + O_2 \rightarrow 2\ H_2O$) Otherwise, the oxygen will be depleted in the formation of water and excess hydrogen would remain, contrary to the teaching in each of **Emesh** and **Chivukula**. Accordingly, one of ordinary skill would clearly recognize that using the more desirable method of "Dryox" oxidation, as taught by **Van Zant**, would necessarily require a range hydrogen to oxygen of 0.67 or less in order to achieve the mixture taught by each of **Emesh** and **Chivukula** which requires excess oxygen with the water, which overlaps the claimed ratio of 0.1 to 0.8 (instant claim 8) and 0.1 to 0.5 (instant claim 5).

Further regarding claims 2-4, although **Patel** does not recite Applicant's exact ranges of either 450-750 °C or 750-900 °C or exact times of 20-60 seconds for the oxidation, **Patel** does disclose an overlapping temperature range of 650-850 °C and time range of 5-30 seconds, in at least one example. **Emesh** teaches 300 seconds, which is a function of the lower temperatures

used. **Chivukula** teaches 30 seconds to several minutes, which are, again, temperature and material dependent. These claims are *prima facie* obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. *In re Woodruff*, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also *In re Aller*, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious). It would have been obvious to one of ordinary skill in the art at the time the invention was made to optimize the temperature and anneal time to provide the best ferroelectric film, according to the precedent above. Also note, although **Emesh** teaches an ozone/water oxidizing temperature of 500 °C or less, **Emesh** also teaches that increasing the temperature at which the wet oxidation occurs increases the dielectric constant of the high dielectric constant film (column 8, lines 6-12) which is desired in the semiconductor device fabrication art especially for fabricating capacitors for DRAM devices. Accordingly, one of ordinary skill would be motivated to use higher temperatures than 500 °C, as suggested by **Emesh** to increase the dielectric constant of the ferroelectric layer to enable smaller capacitors to be formed, which in turn enables further miniaturization of semiconductor devices using capacitors.

Regarding claim 11, **Patel** does not teach performing the ozone oxidizing or the oxygen stabilizing treatments at different temperatures, but each of **Emesh** and **Chivukula** teaches that the addition of water vapor reduces the densification/crystallization temperature from dry conditions.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to perform the wet ozone anneal of **Patel** in view of **Emesh** and **Chivukula** at a lower temperature than the oxygen stabilizing anneal, because each of **Emesh** and **Chivukula** teaches a

lower temperature may be used for wet versus dry oxidation, and provides examples of temperatures lower than in **Patel**.

7. Claim **42** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Patel** et al. (US 5,374,578) in view of either of **Emesh** et al. (US 5,728,603) and **Chivukula** et al. (US 6,066,581) and further in view of US 5,840,368 (**Ohmi**) and considered with the CRC Handbook of Chemistry and Physics 63rd Edition, CRC Press: Boca Raton FL, pp. D-196 to D-197 (used for a showing of inherency only).

The prior art of **Patel** in view of either of **Emesh** and **Chivukula** and the inherent showing from the CRC Handbook, as explained above, discloses each of the claimed features except for indicating that the steam is provided by a catalytic system.

Ohmi teaches a catalytic system for providing steam for wet oxidation. (paragraph bridging cols. 2-3 and col. 4, lines 40-45). **Ohmi** teaches that the catalytic oxidation beneficially reduces the temperature at which an oxidation may occur and provides a cleaner way of providing water (Abstract).

It would have been obvious for one of ordinary skill in the art, at the time of the invention to use the catalytic method of forming steam, taught by **Ohmi**, for the wet oxidation of **Patel** in view of either of **Emesh** and **Chivukula**, for the beneficial reasons just indicated and further because, as noted above, Applicant has not indicated that there exist anything critical to the method by which the water is formed, moreover teaching away from any criticality to such method of steam production.

8. Claim **43** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Patel** et al. (US 5,374,578) in view of the excerpt from **Ghandi**, VLSI Fabrication Principles, 2nd ed. John Wiley & Sons: New York, 1994, pp. 465-466, and either of **Emesh** et al. (US 5,728,603) and **Chivukula** et al. (US 6,066,581) and considered with the CRC Handbook of Chemistry and Physics 63rd Edition, CRC Press: Boca Raton FL, pp. D-196 to D-197 (used for a showing of inherency only).

The prior art of **Patel** in view of either of **Emesh** and **Chivukula** and the inherent showing from the CRC Handbook, as explained above, discloses each of the claimed features except for indicating that the steam is provided by a pyrogenic system.

Ghandi teaches the benefits of using a pyrogenic system formation of steam for oxidation indicating that the method is better than a bubbler and provides better control over the partial pressure of the water and is "well suited for the manufacturing environment." (See paragraph bridging pp. 465-466.)

It would have been obvious for one of ordinary skill in the art, at the time of the invention to use the pyrogenic method of forming steam, taught by **Ghandi**, for the wet oxidation of **Patel** in view of either of **Emesh** and **Chivukula**, for the beneficial reasons just indicated and further because, as noted above, Applicant has not indicated that there exist anything critical to the method by which the water is formed, moreover teaching away from any criticality to such method of steam production.

9. Claim **44** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Patel** et al. (US 5,374,578) in view of either of **Emesh** et al. (US 5,728,603) and **Chivukula** et al. (US

6,066,581) and considered with the CRC Handbook of Chemistry and Physics 63rd Edition, CRC Press: Boca Raton FL, pp. D-196 to D-197 (used for a showing of inherency only).

The prior art of **Patel** in view of either of **Emesh** and **Chivukula** and the inherent showing from the CRC Handbook, as explained above, discloses each of the claimed features of claim 44. Additionally both **Emesh** and **Chivukula** teach that water is provided by a bubbler system (**Emesh** at col. 5, lines 57-59; **Chivukula** at col. 13, lines 40-46).

It would have been obvious for one of ordinary skill in the art, at the time of the invention to also use the bubbler for the wet oxidation, already indicated as obvious over either of **Emesh** and **Chivukula**, for the oxidation of Patel, because this is the manner in which **Emesh** and **Chivukula** provide water vapor and since one of ordinary skill would be motivated to use water vapor, for the reasons indicated earlier, one of ordinary skill would be especially motivated to use the system taught in **Emesh** and **Chivukula** to provide the water vapor.

Response to Arguments

10. Applicant's arguments filed 5 May 2003 (Paper No. 35) have been fully considered but they are not persuasive.

Applicant argues that the references are not properly combinable for several reasons. First Applicant argues in the paragraph bridging pp. 6-7 that Patel allegedly teaches a shorter annealing time (30 seconds) than Emesh (300 seconds), while Emesh teaches that the steam anneal reduce the required anneal time. But Patel clearly teaches that the annealing of the PZT layer may be a single anneal or a plurality of anneals and teaches anneal times up to an hour (Patel, col. 4, lines 55-66). Accordingly, Applicant fails to consider the entire Patel reference.

Emesh would clearly reduce the necessity of the longer anneal times used in Patel. Moreover, Emesh teaches that steam annealing the PZT --not temperature-- reduces stress in the PZT film, stating

> "The initial focus of this effort was a reduction of the crystallization temperature of the PZT from ~650 °C to <500 °C. However, this led to the discovery that the presence of water vapour during annealing has a significant effect in reducing film stress." (Emesh, col. 5, lines 52-56)

Accordingly, there exists motivation to one of ordinary skill to use steam regardless of the respective temperatures or times used. Again Applicant had not considered all of the reasons why one of ordinary skill would combine the references in this regard.

Applicant argues on p. 7, middle paragraph,

> "Patel also particularly benefits from using higher temperatures, e.g., <u>above</u> 500 °C, since ozone molecules will disassociate quickly <u>decreasing</u> the anneal time to less than 30 seconds; thus, increasing the diffusion of oxygen into the ferroelectric crystal <u>and</u> reducing the number of lead atoms that are lost. This is the primary benefit the Patel teaches." (Emphasis in original.)

Applicant further argues in this regard in the last paragraph of p. 7,

> "Patel teaches that the methods disclosed are 'important in that the faster [the] oxygen is provided to the ferroelectric crystal, the few[er] the number of lead (Pb) atoms that will be lost,' (Col. 2, lines 34-36) (emphasis added.) Accordingly, Patel is primarily directed at decreasing the anneal time such that the number of Pb atoms lost is decreased."

First, Examiner respectfully disagrees with the Patel teaching of shorter anneal times than Emesh, for reasons just indicated above. Second, Examiner respectfully disagrees that Patel is "primarily directed at decreasing the anneal time such that the number of Pb atoms lost is decreased." Rather Patel discloses that his invention is directed to "any material of the perovskite crystal type or of high dielectric constant…" (Patel, col. 3, lines 42-46). Accordingly,

Patel most certainly is not directed only to the exemplary embodiment wherein PZT is concerned. Note that all high dielectric constant materials do not contain lead, such that the time is not critical to all materials. And as repeated from above, Patel teaches anneal time of up to an hour. Patel accordingly teaches that the anneal conditions are material dependent. In this regard, Patel states at col. 4, lines 33-35,

> "The type of anneal utilized is based on the ferroelectric characteristic desired at the end of the fabrication steps."

This is an express suggestion in Patel, to one of ordinary skill, to optimize the anneal conditions for the particular "ferroelectric characteristic desired."

Further in this regarding, Applicant appears to argue that Patel's lack of teaching of temperatures of less than 650 °C somehow serves as an argument that there exists no motivation to combine the references. Examiner respectfully but emphatically disagrees. Emesh provides the motivation, as indicated in the rejection above and as incorporated herein by reference.

Applicant argues on p. 8, middle two paragraphs, that Emesh does not support higher temperature anneals, citing col. 8, lines 34-37 of Emesh as support, and further stating, "The presence of wet oxygen and 1% ozone is the only reason the dielectric constant was increased." This is absolutely false; Applicant fails to consider all of the actual data present in Emesh. In the previous action (filed 12 August 2002) and as repeated above in the rejection, Applicant was directed to Emesh at col. 8, lines 6-12 which states,

> "The sample annealed at 450 °C in wet oxygen and the highest concentration of ozone had a dielectric constant near to **500** comparable with samples dry annealed at higher temperatures. Increasing the anneal temperature to 500 °C using wet oxygen **and the same amount of ozone** increase the dielectric constant to **550**." (Emphasis added.)

Accordingly the increase in temperature from 450 °C to 500 °C --**with the same amount of ozone**-- increased the dielectric constant from 500 to 550. So, while ozone increases the dielectric constant, so does temperature alone, as made clear from the above actual results in Emesh. For this reason, it is incorrect for Applicant to say that temperature has no effect on the dielectric constant. This follows logically from Fick's first law of diffusion which indicates that the rate of diffusion, of oxygen in this instance, increases with increasing temperature. Accordingly, Emesh teaches that higher temperatures increase the dielectric constant, such that one of ordinary skill would be motivated to use higher temperatures to achieve higher dielectric constants. Consequently, Emesh does not teach away from using higher temperatures as alleged by Applicant.

Applicant argues in the paragraph bridging pages 8 and 9 that because Patel uses plural anneals to reduce stress that one of ordinary skill would avoid the stress reduction using the Emesh method of introducing water vapor during annealing. Examiner respectfully disagrees. One of ordinary skill would avoid the plurality of anneals used in Patel which would reduce time and increase throughput which is always highly desired in semiconductor fabrication industry. In this regard it is noted that "the strongest rationale for combining references is a recognition, expressly or impliedly in the prior art or drawn from a convincing line of reasoning based on established scientific principles or legal precedent, that some advantage or expected beneficial result would have been produced by their combination." *In re Sernaker*, 702 F.2d 989, 994-95, 217 USPQ 1, 5-6 (Fed. Cir. 1983).

On p. 9 first full paragraph, Applicant repeats the argument about annealing times as was applied to the combination of Patel and Emesh. Examiner respectfully disagrees for the reasons

already indicated above. Patel does not limit anneal time to 30 seconds and teaches anneal times of an hour and further states that anneal conditions are variable depending upon material and its ultimately desired ferroelectric characteristics. Accordingly, Applicant's argument in this regard is not persuasive.

On p. 9, penultimate paragraph, Applicant argues that Van Zant does not cure the deficiencies of the applied art of Patel in view of either of Emesh and Chivukula. Because Patel in view of either of Emesh and Chivukula are not deficient, this argument is not persuasive.

In the paragraph bridging pages 9 and 10, Applicant argues that the applied art does not teach that the annealing is carried out at a pressure of less than atmospheric. First, Applicant has not taught this either. Second, Patel teaches that any temperature may be used, as noted above in the rejection. This is pretty much what Applicant has taught: any temperature below atmospheric pressure. More importantly, the instant specification teaches away from any criticality to the temperature used in the resulting high dielectric constant material used since Applicant also teaches that atmospheric pressure may be used.

Applicant provides no additional arguments regarding the basic textbook of Ghandi, the CRC Handbook, or Ohmi. Instead Applicant's argument is predicated on the perceived deficiency of Patel in view of Van Zant and either of Emesh and Chivukula. For the reasons indicated above, Examiner respectfully asserts that the applied references teach and or suggest each of the features of the instant claims and are properly combined.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erik Kielin whose telephone number is 703-306-5980. The examiner can normally be reached on 9:00 - 19:30 on Monday through Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached at 703-308-4940. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9318 for regular communications and 703-872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Erik Kielin
Erik Kielin
June 16, 2003